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ABSTRACT

Sixty adolescents, stratified by sex and grade level (i.e., 9th, 12th, and college sophomore) participated in an examination of Piaget's suggestion that the formal operations are prerequisite to the development of political idealism, abstract thought and future time perspective in adolescence. Analysis of the cognition data revealed that the frequency of adolescents demonstrating propositional reasoning was significantly higher than that obtained for any of the complementary substages. Subsequent correlation analyses revealed a highly significant, positive association between formal operations reasoning and political idealism, abstract thought, and one of the measures of future time perspective. Finally, no significant differences were obtained between adolescents demonstrating partial vs. complete acquisition of the formal operations, and criterion performance on the measures of political idealism and abstract thought. Contrary to Piaget's suggestion, the findings of this study would indicate that partial acquisition of the formal operations (i.e., propositional reasoning) may be the more characteristic achievement of adolescence. These findings also would indicate that such partial acquisitions may serve as a sufficient cognitive foundation for the development of political idealism and abstract thought to occur. (Author)

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Partial Acquisition of the Formal Operations

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Abstract

Sixty adolescents, stratified by sex and grade level (i.e., 9th, 12th, and college sophomore) participated in an examination of Piaget's (Inhelder & Piaget, 1958) suggestion that the formal operations are prerequisite to the development of political idealism, abstract thought and future time perspective in adolescence. Analysis of the cognition data revealed that the frequency of adolescents demonstrating Substage IIIA, propositional reasoning was significantly higher than that obtained for any of the complementary substages. Subsequent correlation analyses revealed a highly significant, positive association between formal operations reasoning and political idealism, abstract thought, and one of the measures of future time perspective. Finally, no significant differences were obtained between adolescents demonstrating partial vs. complete acquisition of the formal operations, and criterion performance on the measures of political idealism and abstract thought. Contrary to Piaget's suggestion, the findings of this study would indicate that partial acquisition of the formal operations (i.e., Substage IIIA, propositional reasoning) may be the more characteristic achievement of adolescence. These findings also would indicate that such partial acquisitions may serve as a sufficient cognitive foundation for the development of political idealism and abstract thought to occur.

Partial Acquisition of the Formal Operations

In The Growth of Logical Thinking (Inhelder & Piaget, 1958), Piaget describes formal operations reasoning in terms of the two primary abilities manifested by its acquisition: 1) the ability to generate first and second order hypotheses about a given problem; and 2) the ability to cognitively transform and test each of the hypotheses generated to determine a logically supportable solution. Within Piagetian theory, the structures underlying these abilities are referred to as the lattice (or propositional reasoning) and INRC group (or combinatorial analysis), respectively. Piaget further suggests that it is the consolidation of these substructures, and the problem-solving approach engendered, which underlies the political idealism, concern with future roles and abstract thought held to be characteristic of adolescence (Inhelder & Piaget, 1958; Piaget, 1969).

Contrary to Piaget's description of adolescent cognition, however, the published opinion of many is that acquisition of the formal operations is simply not the normative occurence of this period (Brainerd, 1978; Higgens-Trenk & Gaite, 1971; Jackson, 1965; Lovell, 1971; Neimark, 1970a; Tomlinson-Keasy, 1972). Largely in response to these observations, Piaget, in later writings, acknowledged the mediating influence of experiential factors, suggesting that "all normal individuals are capable of reaching the level of formal operations in the condition that the social environment and acquired experience provide the . . .

cognitive nourishment and intellectual stimulation necessary." (Piaget, 1972, p. 8).

Despite this modification however, several problems remain in Piaget's description of the nature and role of adolescent cognitive. First, the description allows only for acquisition of the completed structure. Presumably, where the environmental surround fails to provide sufficient demand, transition to and completion of the final stage simply will not occur. One implication is that the individual may functionally remain at the level of concrete operational thought -- not an altogether successful denouement to the cognitive acquisitions of childhood.

A second problem is the subsequent implication that where the complete stage emerges, it does so within the context of individual interest or expertise, rather than as a generalized approach to the solution of abstract, as well as concrete problems. (Piaget, 1972). In this specific regard, Piaget's reformulation fails to incorporate the intersituational generality typical of preceding structures and stages (Piaget, 1963). Rather, it appears to be an "all or nothing" proposition, wherein the "all" occurs within individually defined contexts. This particular aspect of Piaget's reformulation represents something of a discrepancy with the very theoretical tenents upon which it is based; a divergence which has yet to be addressed by the corresponding research.

The third, and perhaps more serious problem presented by this reformulation is that it continues to attribute certain generative properties to the completed structure (where ever it

emerges) without consideration of the seperate influences of its constituent substructures. In particular, the role of partial cognitive acquisitions during this period receives little consideration. It is quite possible that partial cognitive acquisitions may serve the generative function attributed by Piaget to the completed structure. At the very least, such structures may play a facilitative role.

When youths engage in the production of life plans, for example, they remove themselves from immediate reality to speculate about future possible events, roles and experiences. It may be inferred that they are engaged in the application of intellectual structures to specific content. It may even be inferred that such activity represents the employment of certain of the aspects of formal reasoning. But where it is arguable that propositional thought (or hypothesis generation) may at least facilitate that engagement, it is not arguable that combinatorial analysis (or the capacity to examine the interrelations among the hypotheses generated) is essential to such planning. One need be neither systematic nor exhaustive to envision or consider future goals and idealistic concerns, although certainly such strategies heighten the likelihood of success (and the avoidance of disillusionment). At the same time however, such consideration would require more than a purely concrete approach. Whereas the completed structure of the formal operations may not be prerequisite to the adolescent's development of complementary characteristics during this period (e.g., future time perspective, political idealism, abstract thought), partial acquisition of the

structure may at least facilitate that occurrence.

Sufficient data exist to indicate a consistent pattern of within-subject performance differences across measures of formal reasoning (Dulit, 1972; Jones, 1972; Lovell, 1961; Martorano, 1975; Neimark, 1970a; Tomlinson-Keasy, 1975). It has been suggested, albeit infrequently, that this pattern may reflect a décalage underlying the emergence of the formal operations (Martorano, 1975; Tomlinson-Keasy, 1975). The concept of décalage is not new, however its application to vertical progressions such as that described here has yet to receive other than theoretical attention (Flavell, 1981; Flavell & Wohlwill, 1969). Therefore, the present study was designed to examine the interrelation of partial acquisition of the formal operations (i.e., Substage IIIA, propositional reasoning) and adolescent future time perspective, abstract thought and political idealism.

METHOD

Subjects

Sixty caucasian adolescents, stratified by sex and grade level participated in the present study (i.e., 10 male and 10 female 9th graders; 10 male and 10 female 12th graders; and 10 male and 10 female college sophomores). Mean ages for the ninth and twelfth grade and college sophomore groups were 176, 205, and 231 months, respectively. Adolescents comprising the two younger groups were selected randomly from the college preparatory curriculum of an upper middle class public secondary school, located in suburban Boston, Massachusetts.[1/] College sophomores were selected from a pool of volunteers then enrolled in an introductory psychology class conducted at Boston University. All students were financially reimbursed for their participation in the study.

Procedure

Each participant was interviewed individually in two 45 minute sessions, conducted over a two day period at their respective schools. Two examiners, one male and one female, conducted all participant interviews. Subject-examiner dyads were counterbalanced to control for potential sex bias and examiner effects. All interviews were tape recorded, and examiners made written notes to obtain fuller descriptions of participant response.

Participant interviews (i.e., both sessions) consisted of the following eight tasks. The Equilibrium on a Balance task (Inhelder & Piaget, 1958) was used to measure cognitive level.

Abstract thought was assessed through the use of two tasks: 1) both abstract and concrete forms of the propositional logic task (Wason & Johnson-Laird, 1972); and 2) sixteen verbal analogies (Lunzer, 1965). Two tasks were used to measure adolescent future time perspective: 1) the Future Density (D-1) task; and 2) the Future Sequence Arrangement task (Kastenbaum, 1961). Finally, political idealism was measured using the Landowner vs. Town Council and Mandatory Education tasks (Adelson, 1972; Adelson & O'Neil, 1966).

To minimize potential effects of practice or instrument reactivity, presentation of multiple condition tasks (e.g., propositional logic) was arranged such that only one task condition occured within each interview session. Within interview sessions, however, the order of task presentation was randomized across subjects.

Scoring of interview protocals was conducted by two trained undergraduate assistants, and followed the guidelines set forth by the respective task developers (i.e., Adelson, 1972; Adelson & O'Neil, 1966; Inhelder & Piaget, 1958; Kastenbaum, 1961; Lunzer, 1965; Wason & Johnson-Laird, 1972).[2/] Interrater reliability and agreement coefficients obtained for the various measures were: 1) for the Equilibrium on a Balance task, reliability was .93; 2) interrater reliability for the Mandatory Education task was .90, and for the Landowner vs. Town Council task, .88; 3) interrater reliability was found to be .93 for the concrete condition of the propositional logic task, and .95 for the abstract condition. Since absolute rather than stage scores were

obtained for the analogical reasoning and future time perspective tasks, no reliability indices were computed.

RESULTS

Table 1 presents the distribution of cognitive substages obtained for the present sample.[3/] It is of some interest to note that the frequency of subjects demonstrating Substage IIIA (propositional reasoning) was significantly higher than that obtained for any of the complementary substages ($X^2 = 29.10$, df = 4, $p<.001$). Because of the distribution obtained, it was decided to collapse Substages IIIA/IIIB (Transition) and IIIB to form a single cell (IIIB). The resulting four point scale was used in all subsequent analyses.

Insert Table 1 about here

Correlation analyses revealed significant associations between cognition and: 1) analogical reasoning ($r = .84$, $p<.001$); 2) propositional logic ($r = .68$, $p<.001$ for the concrete condition; and $r = .36$, $p<.001$ for the abstract condition); and 3) political idealism ($r = .33$, $p<.005$ for the Mandatory Education task, and $r = .32$, $p<.005$ for the Landowner vs. Town Council task). However, cognition correlated significantly with only one of the future time perspective measures -- the oldest age at which events were

foreseen ($r = .28$, $p<.05$). Thus, initial data analyses provided some support for Piaget's description of the interrelation of cognition, adolescent political idealism and certain of the aspects of future time perspective. It remained to be determined, however, whether or not this relationship varied with cognitive level. Therefore, a series of frequency analyses were performed to examine the interrelation of partial (Substage IIIA) versus complete acquisition (Substage IIIB) of the formal operations, and criterion performance on the measures of political idealism, and abstract thought. As only one of the future time measures was found to modestly correlate with cognition, these tasks were excluded from the analysis.

For purposes of this analysis, criterion performance on the measures of political idealism and abstract thought was defined as follows. For both the Mandatory Education and Landowner vs. Town Council tasks, the criterion was defined by performance at Level III, or the transition to abstract, depersonalized communal concerns (Adelson & O'Neil, 1966). Correspondingly, criterion performance on the propositional logic tasks (both abstract and concrete conditions) was defined as Level III (partial insight) responses (Wason & Johnson-Laird, 1972). Finally, criterion analogical reasoning was defined as 75% of the total possible score for that task. The results of these analyses are presented in Table 2, below.

Insert Table 2 about here

No significant differences were obtained between the frequency of subjects demonstrating propositional reasoning and criterion abstract thought and political idealism, and the frequency of subjects demonstrating the completed formal operations and criterion political idealism. Rather than the skewed distribution that would be predicted from Piagetian theory, the frequency of adolescents demonstrating partial versus completed acquisition of the formal operations and criterion performance on the complementary variables was comparable. Contrary to Piaget's suggestion then, emergence of the fully elaborated formal operations was not found to be prerequisite to the appearance of political idealism or abstract thought. Rather, these results would indicate that propostional reasoning may represent a sufficient cognitive acquisition to lay the foundation for such developments to occur.

This interpretation must be qualified however, by the observation that several subjects demonstrated criterion performance on the complementary tasks and yet had not acquired Substage IIIA formal operations reasoning. Whether this divergence from the predominant pattern is due to measurement artifact or represents a phenomenological occurence is discernable neither from the data, nor the interview protocals.

DISCUSSION

Similar to the findings of previous research (Lovell & Olgivie, 1961; Lovell & Shields, 1967; Neimark, 1975) only 25%

of the present sample demonstrated the completed formal operations. In contrast, 40% of these students demonstrated acquisition of Substage IIIA propositional reasoning. One interpretation of these and related findings is that partial acquisition of the formal operations may be the more general phenomenon among normal adolescents.

The implication of these findings for Piaget's description of adolescent cognition are twofold. First, it would appear that the frequency of partial cognitive acquisitions may at least approximate the frequency of the completed structure among normal adolescents. Thus adolescents may acquire, at a minimum, such hypothesis generating abilities as would be characteristic of the first substage, propositional reasoning. The capacity to systematically transform and evaluate symbolic representations of such hypotheses would thereby represent a higher, much less frequent, cognitive acquisition. Transition to higher levels of functioning, where it occurs, may be facilitated by experience in a specific domain, and perhaps limited to that domain, as well. What this suggests is an individual capable of multiple levels of functioning, the optimum of which is manifested only in those domains where time and experience have provided greater understanding of the constituent dynamics (e.g., Rest, 1969).[4] In other, less well understood and experienced domains, lower, more stable levels of functioning would predominate (Flavell, 1981; Flavell & Wohlwill, 1969; Siegler, 1981). The results of this study would suggest that for the majority of adolescents that lower, more stable level of functioning may well be Sub-

stage IIIA, propositional reasoning.

The findings of this study also have implication for Piaget's description of the generativity of the formal operations. These findings would suggest that partial, rather complete acquisition of the formal operations may be sufficient to lay the foundation for the appearance of adolescent political idealism and abstract thought. If such is the case, it would do much to account for the discrepancy between the low frequency of formal reasoners observed in previous investigations and the disparately high frequency of those characteristics which, in Piagetian theory, the structure is held to underlie.

Certainly this suggestion is not meant to imply that acquisition of Substage IIIA formal operations serves as both a necessary and sufficient condition for the emergence of political idealism and abstract thought during adolescence. The findings of other research (Greene, 1981; Haan et al, 1982) would indicate that other factors (e.g., concommittant experience) contribute substantially not only to the appearance of such characteristics, but the transition to higher levels of functioning as well. It does suggest, however, a broader perspective from which the role of partial cognitive acquisition can be more fully explored.

In behavioral terms, what I have attempted to describe is the cognitive structure characterizing the individual who produces widesweeping, if somewhat unrealistic expectations of life and relationships. The individual who can articulate impressively ambitious plans, with an astonishing lack of consideration for detail. The individual who consistently fails to anticipate the

probable consequences of his or her behavior. The individual who, despite all appearances, consistently fails to behave in what we consider an adult fashion . . . . that is, the normal adolescent.

Footnotes

1. I should like to thank both the teachers and students of the Belmont School for their enthusiastic participation in, and support of this research.

2. Further information concerning the scoring procedures may be obtained from the author at the address given above.

3. Due to equipment failure, two of the twelfth grade interviews were not transcribable. Therefore, data analyses were conducted on a sample of fifty-eight, rather than sixty adolescent.

4. Although Flavell and Wohlwill (1969) discuss response oscillations with specific reference to transition periods, it is suggested here that the concept has broader applicability, sufficient to include the present instance (e.g., Rest, 1981).

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Table 1

Frequency Distribution of Cognitive Substages
(Equilibrium on a Balance)*

Cognitive Substages:	frequency
Substage IIB Concrete Operations	7
Substage IIB/IIIA (Transition)	14
Substage IIIA Propositional Reasoning	22
Substage IIIA/IIIB (Transition)	7
Substage IIIB Combinatorial Analysis	8

*(X^2 = 29.10, df = 4, $p<.001$)

Table 2

Frequency Analysis of Cognitive Level by Criterion Performance on the Measures of Political/Philosophical Idealism and Abstract Thought (n=58)

	Cognitive Level			
Abstract Thought:	IIIA	IIIB	X^2	p value
Verbal Analogies Task	19	14	0.19	n.s.
Propositional Logic Task (Concrete condition)	14	14	0.00	n.s.
Propositional Logic Task (Abstract condition)	7	11	0.88	n.s.
Political/Philosophical Idealism:				
Mandatory Education Task	19	12	0.16	n.s.
Landowner vs. Town Council Task	19	12	0.16	n.s.

APPENDIX A

INTERVIEW PROTOCAL

POLITICAL ORIENTATION TASK

(Landowner vs. Town Council Scenarios)

I AM GOING TO READ TO YOU A FEW SHORT DESCRIPTIONS OF SOME OF THE PROBLEMS THAT THE GEORGETOWN CITY COUNCIL HAS FACED IN THE PAST FEW YEARS. AFTER I READ EACH DESCRIPTION, I WOULD LIKE YOU TO TELL ME WHAT YOU THINK ABOUT EACH PROBLEM, AND THE WAY YOU THINK IT SHOULD BE HANDLED. I ALSO WOULD LIKE ANY GENERAL COMMENTS OR SUGGESTIONS YOU MIGHT LIKE TO GIVE ABOUT THE TOWN COUNCIL, OR THE PROBLEM I READ. IN CASE YOU ARE INTERESTED, GEORGETOWN IS THE ONLY CITY ON A SMALL ISLAND. THE LOCATION OF THE ISLAND IS NOT IMPORTANT, ONLY THE FACT THAT GEORGETOWN IS LOCATED ON THE ISLAND. DO YOU HAVE ANY QUESTIONS?

Scenario I: Here is the first problem which the Council faced. The Council decided to build a road to connect one side of the island to the other. For the most part, the Council did not have any trouble buying the land on which to build the road, but one man refused to sell his land to the government. The Council offered the man a fair price for his land, but he refused. The man said that he didn't want to move because he was attached to his land, and that the Council could buy another piece of land, and change the direction of the road. Many people thought he was selfish, but a lot of people thought he was right. What do you think of this problem? Who do you think is right, the man or the Town Council? What do you think should be done?

Scenario II: The Council met, and after a long discussion voted that if the landowner would not agree to give up his land for the road, he should be forced to, because the rights of all the people on the island were more important than his. Do you think this was a fair decision?

Scenario III: The landowner was very sure that he was right. He said that the law was unjust, and that he would not obey it. He had a shotgun, and would shoot anyone who tried to make him get off his land. He seemed to mean business. What do you think the Town Council should do?

CONSISTENCY OF FUTURE TASK

I'M GOING TO READ TO YOU A SERIES OF EVENTS WHICH HAPPEN TO A LOT OF PEOPLE. I WANT YOU TO TELL ME HOW OLD YOU MIGHT BE WHEN THE EVENT DESCRIBED MIGHT HAPPEN TO YOU. DO YOU HAVE ANY QUESTIONS?

1. How old might you be when your first grandchild is born? _____
2. How old might you be when you die? _____
3. How old might you be when you are too old to be physically active? _____
4. How old might you be when your child achieves his greatest success in life? _____
5. How old might you be when you retire? _____
6. How old might you be when your first child leaves home? _____
7. How old might you be when your mother dies? _____
8. How old might you be when you have reached middle age? _____
9. How old might you be when your father dies? _____
10. How old might you be when your first great-grandchild is born? _____
11. How old might you be when you can no longer have children? _____

POST OFFICE TASK

(Abstract Condition)

I HAVE FOUR CARDS ON THIS SHEET AS YOU CAN SEE. SOME HAVE NUMBERS, AND SOME HAVE LETTERS. ALL OF THE CARDS WHICH HAVE NUMBERS ON THE FRONT HAVE LETTERS ON THE BACK, AND ALL OF THE CARDS WHICH HAVE LETTERS ON THE FRONT, HAVE NUMBERS ON THE BACK. NOW, IF I TOLD YOU THAT IF A CARD HAS A (D) ON ONE SIDE, THEN IT HAS A (5) ON THE OTHER SIDE, WHICH CARD OR CARDS WOULD YOU TURN OVER TO FIND OUT WHETHER I WAS RIGHT OR WRONG?

S:

E: Can you tell me how you decided to pick card(s) _____?

S:

E: Can you tell me how you decided not to pick card(s) _____?

S:

VERBAL ANALOGIES

I'M GOING TO READ YOU A LIST OF VERBAL ANALOGIES. WHAT I WANT YOU TO DO IS TO GIVE ME THE ANSWER FROM A SET OF MULTIPLE CHOICE ITEMS, THAT YOU THINK IS MOST APPROPRIATE. SOME QUESTIONS WILL HAVE ONLY ONE GROUP OF MULTIPLE CHOICES FROM WHICH YOU ARE TO SELECT ONE ANSWER, AND OTHER QUESTIONS WILL HAVE TWO GROUPS OF MULTIPLE CHOICES FROM WHICH YOU ARE TO SELECT TWO ANSWERS (ONE FROM EACH GROUP). LET'S GO THROUGH SOME PRACTICE ITEMS FIRST, SO WE CAN BE SURE THAT YOU UNDERSTAND THE PROBLEM.

A. BLACK IS TO WHITE, AS HIGH IS TO UP/DOWN/LOW.
B. WHEAT IS TO FLOUR, AS HIDE/NAILS/FEET, IS TO LEATHER/FUR/PELT.

E. DO YOU HAVE ANY QUESTIONS? (IF NOT) LET'S BEGIN.

1. Station/caboose/engine/express, is to train, as port is to ship.
2. Iron is to filings/magnet/rust/ore, as wood is to ash.
3. Tank/army/soldiers/land, is to regiment, as airforce is to airplane/air/squadron/airman.
4. Leather is to soft/shoe/hide, as hard/clay/house is to brick.
5. Rest/food/house/thirst, is to water/hunger/shelter/bed, as clothes is to warmth.
6. Sap is to maple, as apple/cane/resin/tree, is to pine.
7. Foot/house/job/woman, is to man, as hoof is to horse.
8. Square is to octogon, as pentagon/circle/triangle/sphere, is to hexagon.
9. Wheel/engine/radio/hoot, is to horn/seat/pedal/television, as bicycle is to car.
10. Sheep is to flock, as herd/pack/soldier/swarm, is to cow/bee/regiment/wolf.
11. Pea is to green/pod/vine/vegetable, as nut is to shell.
12. Dig is to shovel, as hold/capture/chop/spoon, is to handle/vise/bar/scoop.

POLITICAL ORIENTATION TASK

(Mandatory Education Scenarios)

Scenario I: Here is another problem that the Town Council faced. One of the Council members suggested making a law that would require all children to attend school through the 12th grade. In other words, all children would be required to finish high school. What do you think of such a law? What would be the purpose of this law?

S:

Scenario II: Several people in the town did not like this law. In fact, one of the parents said, "My son is going into my business anyway, and he doesn't need much education for that. That's one reason why I don't like this law." Do you think his son should be required to go to school under this law anyway? Why or why not?

S:

Scenario III: In addition to parents, people who did not have children thought the law was unfair. They thought that it was unfair that they would have to pay taxes to support the school system when they did not have children to enroll in it. What do you think?

S:

FUTURE LIFE EVENTS TASK

WE ALL THINK ABOUT OUR FUTURES AT TIMES, WONDERING WHAT LIFE HAS IN STORE FOR US. WE OFTEN MAKE GUESSES OR PREDICTIONS ABOUT WHAT MIGHT HAPPEN IN OUR LIVES. I WOULD LIKE YOU TO MAKE SOME GUESSES NOW. WHAT DO YOU EXPECT TO HAPPEN IN YOUR FUTURE? TELL ME AS MANY OF THESE AS YOU CAN. YOU DON'T HAVE TO BE ABSOLUTELY CERTAIN THAT WHAT YOU GUESS WILL ACTUALLY HAPPEN. A GOOD GUESS IS GOOD ENOUGH. DO YOU HAVE ANY QUESTIONS? WHAT DO YOU THINK MIGHT HAPPEN IN YOUR LIFE?

(After each life event mentioned by the subject, ask at what age the event is likely to occur, i.e., how old will you be when _____?)

Events	Age

POST OFFICE TASK

(Concrete Condition)

I HAVE FOUR ENVELOPES HERE, AS YOU CAN SEE, SOME ARE FACING YOU AND SOME ARE NOT. IF I TOLD YOU THAT IF AN ENVELOPE WAS SEALED THEN IT HAS A 3 CENT STAMP ON IT, WHICH ENVELOPE OR ENVELOPES WOULD YOU TURN OVER TO FIND OUT WHETHER I WAS RIGHT OR WRONG?

S:

E: Can you tell me how you decided to pick envelope(s) _____?

S:

E: Can you tell me how you decided not to pick envelope(s) _____?

CONSISTENCY OF FUTURE TASK

EACH OF THESE CARDS HAS PRINTED ON IT AN EVENT WHICH COULD HAPPEN IN YOUR FUTURE. WHAT I'D LIKE YOU TO DO IS TO LOOK THROUGH THESE CARDS, AND ORDER THEM THE WAY YOU THINK THEY MIGHT OCCUR IN YOUR LIFETIME. IN OTHER WORDS, THE EVENT YOU THINK WOULD HAPPEN FIRST TO YOU SHOULD BE THE FIRST CARD, THE EVENT YOU THINK WOULD HAPPEN SECOND TO YOU SHOULD BE THE SECOND CARD, AND SO ON. DO YOU HAVE ANY QUESTIONS? (IF NOT) YOU CAN BEGIN.

Card No.	Rank Order
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____
10	_____
11	_____

EQUILIBRIUM ON A BALANCE

I'D LIKE YOU TO SOLVE SOME PROBLEMS USING THIS APPARATUS. IT'S CALLED A BALANCE, AND IT WORKS LIKE A SCALE. YOU CAN PLACE WEIGHTS ON THESE KNOBS TO MAKE THE ENDS OF THE BALANCE EVEN, OR TILT TO ONE SIDE.

ALL OF THE WEIGHTS YOU HAVE BEFORE YOU WEIGH EXACTLY THE SAME, 10 GRAMS. AND, EACH OF THE KNOBS IS ONE INCH APART FROM THE KNOBS ON EITHER SIDE OF IT. THEREFORE, THE KNOB WITH A (3) ABOVE IT IS 3 INCHES FROM THE CENTER, AND THE KNOB WITH A (1) ABOVE IT IS ONE INCH FROM THE CENTER. DO YOU HAVE ANY QUESTIONS? IF NOT LET'S BEGIN WITH SOME OF THE PROBLEMS.

E: First I'd like you to take <u>one</u> (1) weight and place it on one of the knobs, and then I'd like you to balance that with <u>two</u> (2) weights on the other side. The two weights have to be placed on the same side.

<u>Ss</u>:

E: (What are you doing now? How did you decide to move the weight(s) from ____ to ____?)

<u>Ss</u>:

E: Now I'd like you to balance <u>two</u> (2) weights on one side with <u>three</u> (3) weights on the other side.

<u>Ss</u>:

E: (What are you doing now? How did you decide to move the weight(s) from ____ to ____?)

<u>Ss</u>:

E: Now I'd like you to balance <u>six</u> (6) weights on one side with <u>two</u> (2) weights on the other side.

<u>Ss</u>:

E: (What are you doing now? How did you decide to move the weight(s) from ____ to ____?)

<u>Ss</u>:

E: Now I'd like you to balance an <u>80 gram</u> weight on one side with <u>20 gram</u> weight on the other side.

<u>Ss</u>:

E: (What are you doing now? How did you decide to move the weight(s) from ____ to ____?)

Ss:

E: Now I'd like you to balance a 50 gram weight on one side with 10 gram weight on the other side.

Ss:

E: (What are you doing now? How did you decide to move the weight(s) from ____ to ____?)

Ss:

E: Now I'd like to ask you one final question. Can you tell me what you've learned about this balance? Is there a general rule for bringing two unequal weights into balance?

Ss:

E: (Can you tell me what you mean by that? Could you go into a little more detail? Can you show me what you mean by using one of the problems you just worked on?)

APPENDIX B

SCORING MANUAL

Post Office Task

Scoring Criteria
(Abstract and Concrete Condition)

In order for a subject to do well upon either or both forms of the Post Office Task, the rationale provided for each item selected must reflect a single underlying principle. That is, subject judgments should be directed to the discovery and identification of those items which present a possible contradiction or negation of the stated hypothesis. Systematic application of this principle results in the subject's decision to investigate certain rather than all of the items presented, and not to investigate others.

Presented below are the three levels of subject response definitions and examples of each, as well as scoring procedures for this task. Scoring procedures and insight levels for the abstract and concrete conditions will be presented separately. The scoring procedures outlined below are adopted from the description provided by Wason and Johnson-Laird (1968, 1972).

There are three levels of insight which a subject can demonstrate on each of the two Post Office Tasks, through partial, incomplete or complete application of the principle outlined above.

1. No Insight. The subject considers possible verification of the hypothesis to be the only relevant criterion for item selection, and looks for instances of proof only.

2. Partial Insight. The subject considers verification (proof) and falsification (disproof) important in item selection, although confirmation of the stated hypothesis (proof) receives greater emphasis.

3. Complete Insight. The subject considers only falsification important in item selection; and correspondingly searches for possible instances of proof.

Presented in the tables which follow are the conceptual definitions, scoring procedures and sample rationales for each of the three insight levels, across the two Post Office Tasks. Table 1, for example, presents the scoring criteria used in the assessment of subject response to the concrete form of the Post Office Task, and Table 2 presents the scoring criteria used in the assessment of subject response to the abstract condition.

Table 1

Post Office Task: Scoring Criteria
(Concrete Condition)

Level of Insight	Characteristics	Item	Sample Rationale	Scoring	
				Item	Rationale
I (No Insight)	-Ss considers only possible verification (proof) of the hypothesis, as important in item selection. (e.g., looks for possible proof only)	#1 (10¢ stamp showing)	-"I would not turn it over Since it has a 10¢ stamp showing, and not a 3¢ stamp it's not important."	0	0
	-Ss generally select only items mentioned in the stated hypothesis and thus select items #2 (sealed envelope) and #4 (3¢ stamp showing).	#2 (sealed envelope showing)	-"I would turn it over. Since it is sealed, I'd turn it over to see whether it had a 3¢ stamp on the other side."	2	2
		#3 (unsealed envelope showing)	-"I would not turn it over. since it's unsealed, it does not matter what's on the other side."	2	2
		#4 (3¢ stamp showing)	-"I would turn it over. Since it has a 3¢ stamp showing, I'd turn it over to see if it is sealed on the other side. If it is, the statement is true."	0	0

Table 1 (cont'd)

Level of Insight	Characteristics	Item	Sample Rationale	Scoring: Item	Scoring: Rationale
II	-Ss considers both verification (proof) and falsification as important in selecting items to turn over.	#1 (10¢ stamp showing)	-"I would turn it over. Since it has a 10¢ stamp on one side, I'd turn it over to see if it is sealed on the other. If it is sealed then the statement is false."	2	2
	-Ss generally select items #1, #2, and #4.	#2 (sealed envelope showing)	-"I would turn it over. Since it is sealed, I'd turn it over to see whether it had a 3¢ stamp on the other side. If there is a 3¢ stamp, then the statement is true; if not, then the statement is false."	2	2
		#3 (Unsealed envelope)	-"I would not turn it over. Since it's unsealed, it does not matter what's on the other side."	2	2
		#4 (3¢ stamp showing)	-"I would turn it over. Since it has a 3¢ stamp showing, I'd turn it over to see if it is sealed on the other side. If it is, the statement is true."	0	0

Table 1 (cont'd)

Level of Insight	Characteristics	Item	Sample Rationale	Scoring: Item	Scoring: Rationale
III (Complete Insight)	-Ss consider only falsification (disproof) as important in selecting items to turn over. -Ss select item #1 or 2.	#1 (10¢ stamp showing)	-"I would turn it over. Since it has a 10¢ stamp on one side, I'd turn it over to see if it is sealed on the other. If it is sealed then the statement is false."	2	2
		#2 (sealed envelope showing)	-"I would turn it over. Since it is sealed, I'd turn it over to see whether it had a 3¢ seamp on the other side; if not, the statement is false."	2	2
		#3 (unsealed envelope)	-"I would not turn it over. Since it's unsealed, it doesn't matter what's on the other side."	2	2
		#4 (3¢ stamp showing)	-"I would not turn it over. You didn't say 3¢ stamps couldn't come with unsealed envelopes, or only came with sealed envelopes. So it doesn't matter."	2	2

35

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Table 2

Post Office Task: Scoring Criteria
(Abstract Condition)

Level of Insight	Characteristics	Item	Sample Rationale	Scoring: Item	Scoring: Rationale
I (No Insight)	Ss considers only possible verification of hypothesis to be the relevant criterion in item selection (e.g., s/he looks for instances of possible proof only). Cue: Ss searches only items which are mentioned in the hypothesis.	#1 (5 showing)	-"Would turn it over. Since it has a (5) showing I would turn it over to see if it has a D on the back."	0	0
		#2 (D showing)	-"Would turn it over. Since it has a D on the front, I would turn it over to see if it has a 5 on the back."	2	2
	--Ss selects items #1 (5 showing) and #2 (D showing).	#3 (C showing)	-"Would not turn it over. Since it has a C showing, and there can only be a number on the back, it's irrelevant if it has a 5 or a 4 on the other side."	2	2
		#4 (4 showing)	-"Would not turn it over. Since it has a 4 showing and the statement didn't say anything about 4's, it's not important."	0	0
II (Partial Insight)	Ss considers both verification (proof) and falsification (disproof) important in item selection, but the search for confirmation of the state- receives greater emphasis than disconfirmation.	#1 (5 showing)	-"Would turn it over. Since it has a (5) showing, I would turn it over to see if it has a D on the back."	0	0

Table 2 (cont'd)

Level of Insight	Characteristics	Item	Sample Rationale	Scoring: Item	Scoring: Rationale
II (Partial Insight)	-Ss selects items #1 (5 showing); #2 (D showing) and #4 (4 showing.	#2 (D showing)	-"Would turn it over. Since it has a D on the front, I would turn it over to see if it has a 5 on the back."	2	2
		#3 (C showing)	-"Would not turn it over. Since it has a C showing, and there can only be a number on the back, it's irrelevant if it has a 5 or a 4 on the other side."	2	2
		#4 (4 showing)	-"Would turn it over. Since it has a number showing, a 4 there has to be a letter on the back. If the letter is a D, then it would disprove the statement."	2	2
III (Complete Insight)	-Ss considers only falsification (disproof) important in item selection. -Ss selects items #2 (D showing) and #4 (4 showing).	#1 (5 showing)	-"Would not turn it over. Since it has a 5 showing, if there is a C on the other side, it wouldn't disprove the rule. You didn't say 5's couldn't come with other letters."	2	2

Table 2 (cont'd)

Level of Insight	Characteristics	Item	Sample Rationale	Scoring: Item	Scoring: Rationale
III (Complete Insight)	-Ss considers only falsification (disproof) important in item selection -Ss selects items #2 (D showing) and #4 (4 showing)	#2 (D showing)	-"Would turn it over. Since it has a D on the front, there should be a 5 on the back. If there isn't a 5 on the back, the statement is false.	2	2
		#3 (C showing)	-"Would not turn it over. Since it has a C showing, and there can only be a number on the back, it's irrelevant if it has a 5 or a 4 on the other side."	2	2
		#4 (4 showing)	"Would turn it over. Since it has a number showing, a 4, there has to be a letter on the back. If the letter is a D, then it would disprove the statement."	2	2

Future Time Perspective

Scoring Criteria

Four measures of Future Time Perspective are obtained from individual subject protocols. These four measures are:

1. Density: the absolute number of possible events a subject can foresee in the future;
2. Spontaneous Extension: the greatest distance (i.e., highest age) a subject can mentally extend himself/herself into the future;
3. Constrained Extension: the median distance (i.e., median age) a subject can extend himself/herself into the future; and
4. Consistency of Future Time Perspective: the degree of consistency with which the subject can order, chronologically, the events expected to occur in the future.

Three of these measures are scored directly from the subject's protocol, (i.e., density, spontaneous and constrained extension). The fourth measure, consistency of future time perspective, is statistically derived from subject responses to the Future Events Tasks. Scoring procedures for each of the four measures of Future Time Perspective are described below.

Density

The density score is derived from subject response to the Future Time Task (Task #6 in the subject protocol). Subject density scores are equal to the total number of future events spontaneously mentioned by the subject to this question.

In the example provided in Table 3 below, S #999 has named nine events which she can foresee occurring in her future (i.e., college graduation, obtaining a job, entering graduate school, obtaining a master's

degree, obtaining a job, getting married, having children, retiring, and death). As this subject has named nine events, the Density score for that subject is 9.

Table 3

Protocol Excerpt

(Future Life Events)

Events	Age
- graduate from college	21
- get a job	21
- go to graduate school	23
- get a master's degree	24
- get a job	25
- get married	26
- have children	30
- retire	65
- die	90

Spontaneous Extension

The Spontaneous Extension score for each subject is derived from the Future Time Task, as was the Density score. Scores for the Spontaneous Extension measure are equal to the oldest age given by the subject as the expected date of occurrence for a particular event. In the excerpt provided in Table 3, Subject #999 has stated that she expects her death to occur at age 90. As 90 years is the oldest age given for any event by this subject, her Spontaneous Extension score is 90.

Constrained Extension

Scores for Constrained Extension are obtained from subject response to the Future Time Task. Spontaneous Extension scores are derived by computing the median of the 11 ages nominated by the subject as the times of occurrence for those events.

In computing the Constrained Extension score, the following formula is used to obtain the median age nominated by individual subjects:

$$CE\ (mdn) = Xu - \frac{(cf - .5N)}{f}$$

Where Xu = upper real limit;

f = frequency;

cf = cumulative frequency; and

N = sample size
(number of separate ages mentioned)

Consistency of Future Orientation

Consistency scores are arithmetically derived from subject performance on two of the future time perspective tasks; the Future Events, and Future Event Card Tasks.

Consistency scores are obtained through a 3 step arithmetic procedure, in which the subject's ordering of Future Event Cards is correlated with their chronological ordering of the same events in the Future Events Task. Ranks are assigned to the chronological ordering of events for each of the two tasks, as indicated in the following instructions.

a) Future Event Cards: Rank each event corresponding to the subject's ordering of the event cards in that task. For example, the event card which the subject places first in the series

(i.e., the event most likely to occur first) is ranked #1 and the event card occurring last in the series (i.e., the event most likely to occur last) is scored #11. As this ranking is done immediately following the interview session, all you need do is log in the event rankings in the appropriate column for computation of the consistency score.

b) Age at Occurrence of Future Events: Future events for this task are ranked corresponding to the age given by subjects as the expected time of occurrence for that event. The event receiving the youngest expected age of occurrence is ranked (#1), the event occurring at the next youngest age is ranked (#2), and so on, until the event occurring at the oldest age is ranked (#11).

c) Compute Consistency Score: At the conclusion of the ranking procedure, you should have two sets of rankings for the eleven future events. In the third and final step, compute the correlation between the two sets of rankings, using the Spearman Rank correlation coefficient formula presented below.

$$\text{(Spearman) } r_s = 1 - \frac{6 \sum_{i=1}^{N} di^2}{N^3 - N}$$

The resultant correlation coefficient is used as a measure of the adolescent's consistency in planning for, or thinking of the future.

Verbal Analogies Task

Scoring Criteria

Each of the twelve analogical problems presented subjects is scored separately for correctness of the item selected (I score); appropriateness of selection rationale (R score); and the combined score for both item selection and rationale (C score). Although only correct responses are scored, subjects may only receive points for the rationale given, if the item selected also is correct. Thus, a subject who provides the correct rationale, but selects the wrong item would not receive points for that item.

Individual analogical problems are scored corresponding to the number of multiple choice items which they contain. That is, if a problem contains only one multiple choice item to be selected (i.e., problems #1, 2, 6, 7, 8, and 11) Ss are assigned one point (+1) for selecting the correct item, and one point (+1) for the appropriate rationale. Thus, the highest possible combined score for single item problems is 2. If, however, the analogical problem contains two multiple choice items to be selected (i.e., problems #3, 4, 5, 9, 10, and 12); subjects are assigned one point for each correct item selected, and 3 points for the appropriate rationale. The highest possible score for double item analogical problems is 5.

Presented in Table 4 which follows are the correct items, and corresponding rationales for each of the twelve analogies.

Table 4

Verbal Analogies: Scoring Criteria

Analogical Problem	Item	Response Criteria	Sample Rationale	Score I	Score R	Score C
1. Station/caboose/ engine/express is to train, as port is to ship.	Station	Explanations should refer to port and station as points of origin and/or return for their respective item associates. (i.e., train and ship)	"A ship comes back to a port, just like a train comes back to a station."	1	1	2
2. Iron is to filings/ magnet/rust/ore, as wood is to ash.	Rust	Explanation must address the decomposition process which relates the given items, wood and ash. That is, that ash is a decomposed/altered form of wood.	"When wood breaks down, or burns, it turns into ash and when iron breaks down, or gets wet, it turns into rust."	1	1	2
3. Tank/army/soldiers/ land is to regiment, as airforce is to airplane/air/squadron/airman.	Army; Squadron	Explanation must refer to the part-whole relationship between the items. For example, a regiment is a unit within an army, and a squadron is a unit within the airforce.	"A squadron is part of the airforce, like a regiment is part of the army."	2	3	5
4. Leather is to soft/ shoe/hide, as hard/ clay/house is to brick.	Shoe; Clay	Explanations must refer to the given items as components of the analogical terms. For example, shoes are made of leather as bricks are made of clay.	"Leather is used to make shoes, and clay is used to make bricks."	2	3	5

Table 4 (cont'd)

Analogical Problem	Item	Response Criteria	Sample Rationale	Score I	Score R	Score C
5. Rest/food/house/ thirst is to water/ hunger/shelter/bed, as clothes is to warmth.	House; Shelter	Explanation should address the "source-object" relation between items. A house is a source of shelter, as clothes are a source of warmth.	"A house provides shelter, and clothes provide warmth."	2	3	5
6. Sap is to maple, as apple/ cane/resin/ tree is to pine.	Resin	Explanation should address the source-object relation between the items. Maple trees are a source of sap as pine trees are a source of resin.	"Sap comes out of a maple tree and resin comes out of a pine tree."	1	1	2
7. Foot/house/job/ woman is to man, as hoof is to horse.	Foot	Explanation should address the anatomical relation between items.	"A man walks on his feet, and a horse walks on its hooves."	1	1	2
8. Square is to octagon, as pentagon/circle/ triangle/sphere is to hexagon.	Triangle	Explanation should address the proportional relationship between terms. A square has half as many sides as an octagon, and a triangle has half as many sides as a hexagon.	"A square has 4 sides and an octagon has 8, so it must be a triangle, since it has 3 sides, and a hexagon has six."	1	1	2

Table 4 (cont'd)

Analogical Problem	Item	Response Criteria	Sample Rationale	Score I	Score R	Score C
9. Wheel/engine/radio/hoot is to horn/seat/pedal/television, as bicycle is to car.	Radio; television	Explanation should address the class membership common to the analogical items (e.g., car and bicycle are both forms of transportation; radio and television are both forms of communication). Or, explanation should refer to temporal relation between items (e.g., bicycle came before cars; and radios came before television).	"Cars and bikes are both means of transportation, and radio and television are both means of communication." "Bicycle was developed before the car, and the radio came before television."	2	3	5
10. Sheep is to flock, as herd/pack/soldier/swarm is to cow/bee/regiment/wolf.	Soldier; Regiment	Explanations should refer to the part-whole relation between items.	"A sheep is part of a flock, and a soldier is part of a regiment."	2	3	5
11. Pea is to green/pod/vine/vegetable, as nut is to shell.	Pod	Explanations should refer to the function relationship between items (i.e., pods contain peas and shells contain nuts).	"Peas come in a pod and nuts come in a shell."	1	1	2

(1½) (3.7)

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Table 4 (cont'd)

Analogical Problem	Item	Response Criteria	Sample Rationale	Score I	Score R	Score C
12. Dig is to shovel, as hold/capture/ chop/spoon, is to handle/vise/bar/ scoop.	Hold; Vise	Explanations should refer to either the action-object relation between items or to the verb-noun relation.	"You dig with a shovel, and hold things with a vise." or "You dig with a shovel, and you hold by a handle." or "Dig is the verb and shovel is the noun that goes with it; and hold is a verb and vise is the noun that goes with it." or "Dig is the verb, and shovel is its noun; and hold is a verb, and handle is its noun."	2	3	5

Political Orientation Task

Scoring Criteria

Each of the six items comprising the two Political Orientation Tasks is scored separately (i.e., the Landowner vs. City Council Task items (1), (2) and (3); and the Mandatory Education Act Task items (1), (2) and (3)). Subject responses to each individual task item are scored twice, in order to assess both the level (i.e., egocentric-concrete vs. sociocentric-abstract), and content (i.e., agreement/disagreement with stated proposition, and rationale). As the procedures for scoring response level and content differ somewhat, they are discussed separately below. Further, the scoring procedures discussed below were derived from those outlined by Adelson and O'Neil (1966).

Level of Subject Response

There are three different levels which can be identified in subject responses to the task items listed above: (1) egocentric-concrete; (2) transitional; and (3) sociocentric-abstract. Levels of subject response are differentiated on the basis of frequency of occurrence of 12 possible rationale characteristics. These characteristics are:

- Personalism vs. Communal Approach. Personalization of interactions within the community, and between the government and community, as opposed to the tendency to abstractly conceptualize the social process and community welfare.
- Concrete vs. Holistic. Predominant perception of government in terms of its specific activities, as opposed to perception of government as an autonomous, whole entity with a variety of functions.

. Negativism vs. Positivism. Emphasis placed upon coercive or negative aspects of government activities, vs. emphasis placed upon more complex, generally positive aspects of government activities.

. Present vs. Future Time Perspective. Emphasis upon the immediate (individualized) consequences of social processes vs. predominant consideration given to future (communal as well as individual) consequences of social processes.

. Force of Principle. Reiteration of social cliches or mores (frequently contradictory) vs. argument from a principled position which subsumes the present instance (generally consistent in application).

. Consideration of Mediating Factors. Reiteration of initial arguments without consideration of mediating factors or alternatives to problem resolution vs. introduction and consideration of mediating factors or alternatives to resolution of the problem.

Political orientation is statistically defined by the frequency with which certain rationale characteristics appear in the subject's response. For example, if chi-square analysis (or binomial test) reveals that a subject makes use of personalism, negativism and cliches significantly more often than any other rationale characteristic, s/he is classified as Level I. If no significant differences are observed in the response characteristics, (i.e., bimodal distribution of Level I and Level III response characteristics) the subject is classified as Level II, Transitional. All analyses performed for this purpose assume the null hypothesis and .10 levels of significance.

Further descriptions of the distribution of response characteristics which distinguishes Level I (egocentric) and Level III (sociocentric) are provided in Table 5 below, with corresponding sample responses. As the second level, Transitional Political Orientation, is typified by the bimodal distribution of the responses characterizing Levels I and III (Adelson & O'Neill, 1966) it is not included in Table 5.

Table 5

Political Orientation Scoring Criteria
Level I: Egocentric-Concrete

Characteristic	Description	Sample Response	Score
PERSONALISM	- Ss discusses social processes and institutions as if comparable to individuals or personal relationships - Frequent use of personal pronouns, where impersonal more appropriate - Differentially emphasizes personal consequences to the exclusion of social consequences - Discusses political realm and political activities in terms of personalized (separate) individuals rather than community	Ss: Well, I don't think they (City Council) should forbid it, but if they did, if he did, well most people would want to put up an argument about it.	1
CONCRETE APPROACH	- Ss discusses functioning or purpose of agencies, social institutions or laws in terms of specific concrete activities.	(Item: What is the purpose of government) Ss: "Well buildings, they have to look over buildings that would be...um, that wouldn't be any use of the land if they had crops on it or something like that or inspect highways."	2
NEGATIVISM	- Ss emphasizes negative aspects of government - Ss articulates a rather authoritarian position, agreeing frequently with actions of government representatives without consideration, or expresses ready agreement with collective will.	(Item: What is the purpose of government) Ss: "To handle the state...so it won't get out of hand...so everything won't go wrong."	3

Table 5 (cont'd)

Characteristic	Description	Sample Response	Score
PRESENT TIME PERSPECTIVE	- Ss emphasizes immediate, concrete (typically personal) consequences of present actions - Does not consider future implications/ consequences of specific actions	Ss: Well, if they don't, people would get mad nobody would do anything... nothing much would happen....	4
FORCE OF PRINCIPLE	- Subject articulates commonly held sentiments, but cannot transcend cliches - Unable to argue from a principle of social order or sense of community - Paraphrases the question or repeats original response - Frequent use of contradicting arguments	Ss: "Yes. The rights of the majority should come before the rights of the individual, when they are right." (What would happen if the rights of the majority didn't come first?) "I don't understand. You know... nothing would happen."	5
CONSIDERATION OF MEDIATING FACTORS	- Subject does not voluntarily consider mediating factors or alternative causes/resolutions in discussing the problem - Subject suggests limited number of mediating factors only after interviewer probes.	(Item: Why do you think the council might want to build the road?) Ss: "It's easier I guess to travel from ond side to the other of the island. (Any other reason?) Ss: No that's it. (Why would it be important to have easy access?) Ss: I don't know, it would be easier to travel I guess.	6

Table 6

Political Orientation Scoring Criteria
Level III: Sociocentric-Abstract

Characteristic	Description	Sample Response	Score
COMMUNAL APPROACH	- Subject demonstrates an understanding of abstract concepts of community and social/political processes by discussing same on abstract level (i.e., without personalizing) - Discusses individual as well as communal consequences of specific actions - Gives some consideration to needs of community vis a vis demands of social order	...the children that graduate eventually pay back the community...um because the more education he has then the more he can as I said before, the more he can give back to the community... and eventually he's going to have to be paying taxes on the same school.	7
HOLISTIC APPROACH	- Subject discusses social institution as whole entities rather than exclusively in terms of specific activities - Discusses government (i.e., City Council and the laws it promulgates) in a general, and abstract, rather than specific concrete fashion	(Item: What is the purpose of governments?) Ss: ...To maintain order in the uh, society..you know...to make sure to protect everyone's rights welfare and uh...safety...and make laws	8
POSITIVISM	- Subject articulates more complex, generally positive view of government. - Generally stresses administrative aspects (e.g., "keeping machinery oiled") - Emphasizes melioristic government activities (e.g., enhancing the human condition) - Little agreement with authoritarian or coercive forms/activities of government	...it's a pretty good law. I think it should go through because, um, people you know if they didn't if they weren't pushed...won't even bother to graduate ...and eventually they won't end up doing much with their lives.	10

Table 6 (cont'd)

Characteristic	Description	Sample Response	Score
TIME PERSPECTIVE	- Subject discusses future consequences of activities in present. - Considers social or communal impacts of certain activities, as well as personal impacts.	(Value of Education) Ss: A person should have a perspective and know a little about as much as he can...if not they'd be prejudiced...and wouldn't be able to understand any other people's needs	11
CONSIDERATION OF MEDIATING INFLUENCES	- Subject voluntarily introduces/ suggests variables for consideration which may influence resolution of the problem - Discusses merits and debits of each potentially mediating variable in discussing problem	(Is the road's construction a good idea?) Ss: it's hard to say...if there was a lot of people on one side and like a hospital on the other	12

. Response Content

Following the procedures described by Adelson and O'Neil (1966), subject responses are scored for content, as well as level. In this instance response content is defined as disagreement/agreement with the stated item proposition, and the specific rationale given to support that agreement or disagreement. Each of the six items comprising the two Political Orientation Tasks is scored separately.

For all item responses, subject disagreement with the stated proposition is scored one (1); and agreement with the stated proposition is scored two (2). The scoring for specific response categories corresponding to individual task items are presented by item in Table 7 below.

Table 7

Item Response Category
(Political Orientation Task)

Task Item	Item Content	Response Categories	Score
I.1	Council proposes to purchase land from current owner to build a road which will connect both sides of the island. Owner doesn't want to sell. What do you think?	. Landowner should sell, community needs came first.....	1
		. Detour should be made, individual rights come first.....	2
		. Emphasis on social responsibility, individual should be appealed to, but not forced.....	3
		. Ambivalence, individual's right, but in some ways wrong.....	4
		. Other.....	5
I.2	Council decides to force landowner to move, as community is more important. Is this a fair decision?	. Yes, rights of others comes first.....	1
		. No, individual rights come first.....	2
		. No, social responsibility should suffice.....	3
I.3	Landowner says law is unfair. Obtains gun and threatens to shoot intruders. What should council do? Do you agree with the Landowner's actions?	. Detour road.....	1
		. Government coercion justified (i.e., force seizure of land).....	2
		. Attempt dialogue, but no violence by council	3
II.1	Council suggests mandatory education law requiring high school attendance to age 18 (i.e., complete high school). What would be the purpose of such a law?	. Continuity of community	1
		. Intrinsic value of education.....	2
		. Practical value of education.....	3
		. Better employment potential.....	4
		. Avoidance of delinquency	5
		. Provide individual more choice in future plans	6
		. Personal fulfillment..	7

Table 7 (cont'd)

Task Item	Item Content	Response Categories	Score
II.2	Should people without children pay taxes to support this law?	. Continuity of community in future.....	1
		. Communal reciprocity for services received..	2
		. Avoids high unemployment.....	3
		. Communal responsibility	4
II.3	Parent stresses son will go into family business and therefore won't need education. Should son be required to attend school?	. Education needed to function in community.....	1
		. Intrinsic value of education.....	2
		. Education useful in business.....	3
		. Prevention of undue parental control or coercion.....	4
		. Personal fulfillment..	5

Equilibrium on a Balance

(Scoring Criteria)

Subject response to each of the five problems comprising this task are scored separately, following the substage criteria presented in Table 8 which follows. Cognitive stage level on the Equilibrium Task is derived from the subjects modal response across all five tasks.

The Equilibrium Task assesses the child's ability to generate and invert the metrical relationship between the three factors involved (i.e., weight of W_1; weight of W_2 and inclincation of the plane) prerequisite to the achievement of equilibrium. In essence, the subject must engage in the following cognitive manipulations in order to achieve true resolution of the problem: *

1. Isolate and maintain cognizance of the three factors involved in the problem (i.e., $weight_1$; $weight_2$; and inclination of the plane).

2. Establish qualitative correspondence between the heaviness of a weight, and its placement on the scale (i.e., the heavier the weight, the greater the impact of its displacement from the fulcrum).

3. Abstract the metrical correspondence for the relationship between the two weights (i.e., generate ratios of W_1 to W_2). This presupposes the child's conceptualization of both arms of the balance as a single dimension.

4. Generate the metrical correspondence of W_1 placement to W_2 placement necessary to achieve equilibrium. At this point the child typically

*Younger subjects may achieve equilibrium through random, disoriented weight displacements; but they are rarely able to do so consistently (without a good deal of trial and error attempts, or to articulate a coherent principle guiding their activities.

engages in additive rather than multiplicative correspondence.

5. Invert the metrical relationship (i.e., ratio) of W_1 placement to W_2 placement, to compensate for differential effect of heavier or lighter weight (multiplicative compensation, or inverse proportionality).

Table 8

Equilibrium on a Balance
(Scoring Criteria)

Substage	Behavioral Characteristics	Numeric Score
IIA	- Subject achieves equilibrium by exception, and only through disoriented (random) placement of weights on each arm.....	11
	- Balance is manipulated through successive additions and substractions of weights. Weights equalized (i.e., treated as if of equal amounts), and added and placed exactly (i.e., weights manipulated in one inch increments or decrements).....	12
	- Distances (relative to the fulcrum) are manipulated, but subject fails to compensate for the differential incline of the balance as a result of weight displacements.....	13
	- Subject demonstrates limited understanding that heavier weight "weighs less" closer to the fulcrum, and that the lighter weight "weighs more" further from the fulcrum, but fails to coordinate the effect of weight displacements on one arm of the balance with corresponding weight displacements on the second arm. Occasionally compensates for incorrect weight displacements through direct, physical manipulation of the balance (i.e., attempts to hold balance in equilibrium).....	14
	- Subject fails to articulate an understanding of the three factors involved (i.e., $weight_1$; $weight_2$; and inclination of the balance) in achieving equilibrium. Angle of inclination rarely taken into account during successive weight displacements.....	15
IIB	- Subject articulates limited understanding of the three factors to be considered ($weight_1$; $weight_2$; inclination). Weights are no longer equalized, but treated as separate entities to be taken into consideration.....	21

Table 8 (cont'd)

Substage	Behavioral Characteristics	Numeric Score
IIB	- Subject demonstrates general understanding of correspondence between weight and distance (relative to the fulcrum) for each arm independently, but fails to draw inferences between them. Each arm of the balance treated as an independent entity, with no compensations between arms (e.g., "This one is heavy so it has to go closer to the middle. This one is light so it goes far out.").....	22
	- Subject employs oriented (as opposed to random) weight displacements, in manipulating the balance. Subject frequently articulates hypotheses that the heavier weight will weigh more further out.....	23
	- Subject expresses qualitative statements concerning correspondence between arms, and searches for principle underlying displacements which will effect equilibrium. Unable to invert relationship between weight and distance on opposing arms. Subject employs an additive model of compensations in weight displacements to effect equilibrium.....	24
IIIA	- Subject treats two arms of the balance as a single continuum or dimension. Inclination of plane frequently anticipated, and displacements adjusted prior to stabilization of incline.....	31
	- Subject articulates (metrical) understanding of proportionality. Able to articulate relationship between differential weight of $weight_1$ and $weight_2$ (e.g., "this one is twice as heavy as that one" or "this one is half the weight of the heavier one.").....	32
	- Articulates understanding that the relationship of $weight_1$ to $weight_2$ has to approximate relation of $distance_1$ to $distance_2$, but fails to invert the proportional compensation (i.e., given 10 and 20 gram weights, subject places the 10 gram weight at one inch from fulcrum and 20 gram weight at two inches).....	33

Table 8 (cont'd)

Substage	Behavioral Characteristics	Numeric Score
IIIA	- Subject articulates qualitative understanding of inverse proportionality. Subject approximates the correct relationship between weight and distance, but subsequent (minor) displacements required to achieve equilibrium.....	34
IIIB	- Subject articulates metrical principle of inverse proportion underlying the achievement of equilibrium (e.g., "you have to figure out the ratio of this weight to this one, and use that to figure out where to put them on the scale. But you have to turn the distance around...see if one weight (H) is twice as heavy as the other (L), then you put it at half the distance (H) that you put the other one (L)").....	41
	- Subject uses oriented (typically correct) compensations prior to placement of weights. Displacements occur where this is an arithmetic error in computing ratios.....	42
	- Subject able to articulate why the inversion of distance ratio is required (i.e., to compensate for differential inclincation produced by placement of heavier weight further from fulcrum; and the converse for placement of lighter weight closer to the fulcrum), and therefore, principle of inverse proportionality.....	43